# BIBLICAL CREATION

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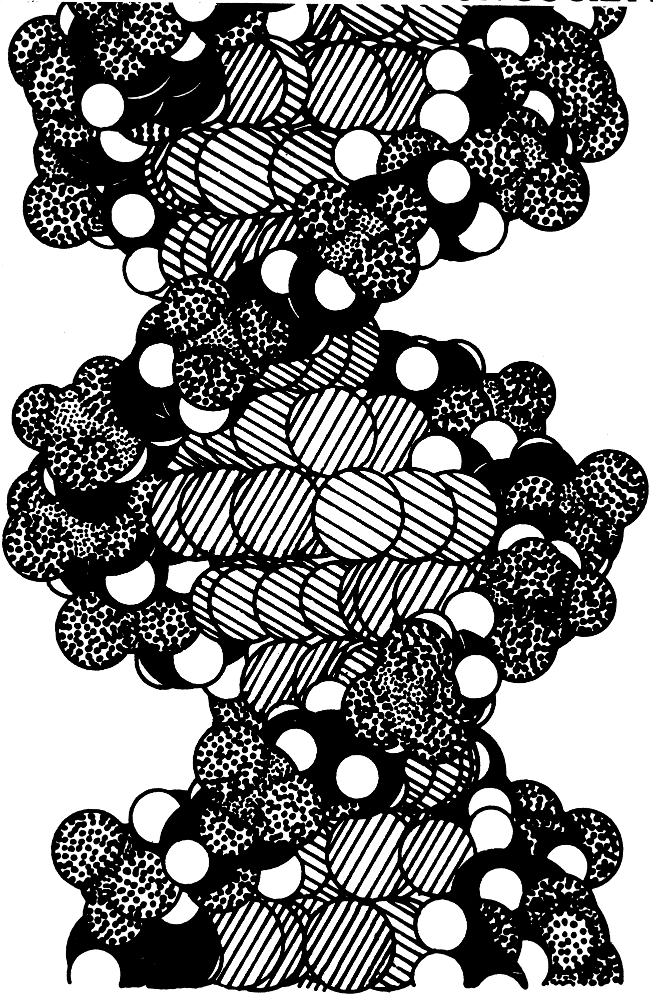

A molecular model of double-helical DNA.

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# EDITORIAL

## Taking Stock

Charles Darwin has now slept beneath the hallowed ground of Westminster Abbey for a hundred years, honoured and revered as the greatest and most influential naturalist of all time. There can be no doubt as to his greatness in the sense of the influence and consequence of his work. The doubts are about something else.

In a recent review of the celebrations now about to take place, a writer in *The Times* noted that there were in fact colossal holes in Darwin's arguments. That this could be said in that journal of the establishment (and spark off a correspondence which included a letter from the Administrative Officer of *BCS*) is a sign of the times! Suddenly what some of us have been saying for years has become the conventional wisdom: there are major flaws in the traditional case for Darwinian evolution.

But it is important that we should not rejoice prematurely at the death of Darwinism, and that involves appreciating the subtle and complex nature of major scientific theories and the way in which they operate. Just because a theory is shown to have problems does not mean that it is abandoned — in the same way as someone does not give up his Christian faith just because he comes up against difficulties. We are Christians and we stay Christians even when we meet problems that we can't answer. We consider that the reasons why we hold onto our faith are stronger than any challenge, however real it may be. By the same count, the evolutionist is not going to abandon the essential view he takes of nature for want of an answer to difficulties in, say, the fossil record.

That is another way of drawing attention to the web of scientific and theological factors which constitute a theory of origins. As has been pointed out more than once in these pages, a difficulty which some of us have with the way in which debate is being conducted in the States is that it appears to deal with both evolution and creation as if they were theories merely of 'science' — such that 'scientific creationism' is a tenable, teachable, defensible entity in itself. The Constitutional position obviously affects attempts to influence the public educational system. But the principle that in creation, *as in evolution,* religion and science are intertwined inextricably is the key to our Christian creationist case.

The secular view of the world demands that evolutionists (including Christian evolutionists, who accept basically the rules of the game of secular science) should have a way of understanding the world *without the need for recourse to God as an explanation.* Fundamental problems with neo-Darwinism are now presenting themselves, but they will lead hardly anyone to abandon the idea of evolution — anyone, that is, who was strongly wedded to it when the debate erupted. It *has* led, and will continue to lead, to creationism's being treated with a new seriousness and a fresh newsworthiness by the media, which is much to be welcomed. But we must limit our expectations. The scientific community is not going to abandon evolution any more than, for example, we are going to abandon our position if a credible genetic mechanism for sudden jumps in evolution is suggested.

But it is undeniable that the credibility of our religious and scientific position has been greatly strengthened by the recent lapse in neo-Darwinian morale. And that is something we must exploit to the full.

Nigel M. de S. Cameron.

## Contributors to this issue

*Dr. Grant Lambert* is a research worker in Biochemistry at Liverpool Univeristy, having recently moved to Australia.

*Dr. Michael Reiss* is currently the Senior Rouse Ball Student at Trinity College, Cambridge.

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# NEWS ITEMS

## Call For Papers

The 1983 National Creation Conference and Semi-annual Convention of the Bible-Science Association will be held in the Minneapolis-St. Paul area August 10 to 13, 1983. Papers are being solicited in all fields of natural science, life science, and social sciences, as well as theological. Papers may describe original work, work of others which the author has studied, or be of a general tutorial nature. Papers may be aimed at scientists or laymen. Also solicited are programs for children, media offerings, etc. Booths are available for display of Creationist materials.

Papers will be refereed for their professional excellence, and perceived general interest to conference attendees. They will not be accepted if they endorse uniformitarian or evolutionist principles, since papers of that nature are more appropriate in other forums. Referees will assign presentation periods ranging from 20 minutes to 50 minutes.

Send abstracts of 500-words minimum to the Program Chairman, Bible-Science Association 2911 E. 42nd Street, Minneapolis, Mn. 55406. Abstracts are due by June 30, 1982, and cannot be returned.

# Rebirth of Creationist Campaign

Teaching material produced by anti-Darwinian groups in the United States is being used in some British schools.

American tape slide programmes are being distributed by the British-based Biblical Creation Society, a 700-member fundamentalist organisation which is compiling a register of teachers sympathetic to the creationists' cause.

Some of the programmes have only been screened in school Christian fellowship meetings but others have been used during science and biology lessons.

One of the films, *I am somebody special,* is designed for children under eight and seeks to show that humans are different from animals because they are made in God's image. Another film for older children, *It's a horse of course,* argues that modern horses did not evolve from early horses.

The society's education officer, Mrs Ann Kirkwood, one of the BCS's two part-time workers, said they had imported the films as a stopgap measure because their own "home-grown" teaching aids would not be available until later this year.

"It's impossible to say how many schools will eventually use the material but more than 100 of our members are teachers," said Mrs Kirkwood, who is herself a former teacher. "We're not seeking to bombard schools with propaganda. All we are saying is that if schools want this information we will make it available to them."

"We hope they will, for we believe schools should present both sides of the argument and treat evolution as a theory rather than a fact."

The BCS was set up five years ago by a group of academics who feel there is too much uncritical acceptance of evolution by universities, schools and other less directly educational institutions such as the BBC and the Natural History Museum.

Members of the BCS believe that neither creation nor evolution can be proved or even really tested but they maintain that the Biblical teachings match the observed scientific data just as well or even better than evolutionary theories.

One of the ways in which they justify this argument is by pointing out that there are no animals either living or in fossil form which possess transitional evolving structures such as scales turning into feathers.

The BCS is interdenominational but inevitably many of its members belong to either the Baptist Church or one of the evangelical churches. It produces a journal every four months and has a modest annual budget of £10,000. But to date it has received very little media attention, largely because it is far less vocal than its American counterparts.

The society's chairman, the Rev. Nigel Cameron, a Church of Scotland minister based in Edinburgh, admitted that the BCS was taking a strong interest in the American fundamentalists' legal fight to have creation taught as a science (a judge recently ruled that an Arkansas statute compelling teachers to give equal time to the theories of evolution and divine creation violated the First Amendment on separation of the Church and state and was therefore unconstitutional). But he emphasised that the society had no plans to follow their example.

"Quite frankly we're not as strident as the American fundamentalists," he said. "And I can't see in any case how they can argue that creationism isn't religious. It's both religious and scientific."

Reprinted, with permission, from 'Teacher', the official publication of the National Union of Teachers, March 1982.

# CORRESPONDENCE

Trinity College
Cambridge CB2 1TQ

## Human Life Support Factors In Genesis One Reconsidered

Dear Sir,

I am writing in response to Mr Gerald Duffett's article entitled "Human Life Support Factors in Genesis One" printed in the February 1982 issue of *Biblical Creation* (vol. 4, no. 11. pp. 25-27).

Mr Duffett attempts to demonstrate a "perfect correlation" between a time parameter — which reflects the creation order of energy, oxygen, water and food — and the logarithm of the period of human survival once each of these factors is withdrawn. For example oxygen is given a time parameter of 1.5 on the grounds that it was created "mid-Day 2", and a log survival period of 2.86 as this is the common logarithm of 720, the number of seconds humans can survive without oxygen. Mr Duffett concludes that the perfect correlation between these two variables can result only from the Creator's deliberate planning.

This is a very interesting idea, but I do not feel that the data fully support Mr Duffett's argument.

(1) Inadequate evidence is cited in support of the survival periods used: energy = 0 seconds; oxygen = 12 minutes; water = 2 days; food = 54 days. In particular 2 days for the period of human survival in the absence of water is surely an underestimate. Queen Esther, her maids, Mordecai and all the Jews to be found in Susa neither ate nor drank for three days and nights (Est. 4 v. 16). Paul, on his arrival at Damascus, also ate and drank nothing for three days (Acts 9 v. 9). The 1982 edition of the Guinness Book of Records (McWhirter, N. (Ed.), Guinness Superlatives Ltd., Enfield) gives 40 minutes as the maximal survival period without air; 18 days as the maximal survival period with neither food nor water; and 94 days as the maximal survival period without food. Parenthetically one might note the miraculous fasts of Moses and Elijah. For two separate periods of forty days and forty nights Moses was in the presence of God, neither eating nor drinking (Deut. 9 v. 9, 18; Exod. 34 v. 28). Similarly Elijah miraculously survived forty days and forty nights with neither food nor water (I Kings 19 v. 8).

(2) Some of the time parameters used are surprising. Energy is understandably given a value of 0.5 since light is a form of energy, and light was created on the first day, while oxygen is given a value of 1.5 on the grounds that it was created on day 2: "Firmament between sea level and clouds is troposphere where air is richest in oxygen". However, water is given a value of 2.25: " = mid-1st ½ Day 3. Sorted out before plant life appeared". It could be argued that water was created on the first day since the Spirit of God moved upon the face of the waters (mayim, Gen. 1:2). Water is also mentioned on day 2 (Gen 1 v. 6-8). Food is given a time parameter of 2.75: "= mid-2nd ½ Day 3" on the grounds that plants were created during the second half of day 3. It is debatable whether 2.5 or 2.75 is the more appropriate value.

(3) The logarithm of 0 is minus infinity, not 0. Table 1 and figure 1 of Duffett's paper are accordingly incorrect.

(4) When the Pearson product-moment correlation coefficient for the data in Duffett's tables 1 and 2 is calculated — omitting the energy values because of point (3) above — the value is indeed extremely high: r = 0.9996 with 2-tailed 95% confidence limits from 0.6464 to 1.000. However this correlation disappears, of course, if the energy values are correctly incorporated (i.e. log survival period equals minus infinity). Similarly if the data (even excluding the energy values) from points (2) and (4) above are used, the correlation disappears.

(5) Even if a perfect or highly significant correlation could be demonstrated between these two variables, what are the grounds for using log survival periods rather than survival periods per se?

Finally the whole attempt to provide proof or even evidence for deliberate planning in creation by this method seems to be dubious.

Yours sincerely

Michael Reiss

## Response

Dr. Michael Reiss' letter deserves a fuller answer than my brief reply.

Point (1) *'Inadequate Evidence'.* What surprised me was the existence of any evidence at all! Who would go without specific life-support factors in order to have someone else measure their survival period from cessation until death? In hospitals, people with breathing difficulties are given oxygen and those unable to eat &/or drink are given chemicals by intravenous drip method. As I was interested in ordinary survival periods rather than atypical ones prolonged by medical aids or miraculous maintenance, I chose to use independent and verifiable 20th Century sources, not, however, because I doubted scripture.

Point (2) *'Surprising' Time Parameters.* My choice of Day 3 for water must have mystified several readers owing to the omission of a typescript paragraph from the published article. Until *Dry Land* appeared in Day 3, sea-water (whatever its salt content) would have been more suitable for drowning rather than for drinking because man is terrestrial and air-breathing. Rain did not fall until the time of Noah, so drinking water was produced by condensation from heavy mists as well as springs on land. If we assume that the evaluation of each life-support factor took as much time as its creation, then it is not debatable to give drinking water the time parameter value of 2.25 and plant food 2.75 days.

Point (3) *Incorrect Logarithm* and its Repercussions (4) & (5). I am grateful to Dr. Reiss for his correction of an elementary error in my article. Would it be intellectual suicide to change the 'zero second' values in the two central columns along the Energy line in Table 1 to 'one second' values? I think not because of the following reasons.

(a) Electron flow must take some time to occur rather than obsolutely no time.
(b) Archaeological methods of dating based upon radio-carbon have a wide margin of error involving +/– several years.
(c) Minus infinity could not be plotted on a graph paper of finite size.

If the above small change is allowed, then the log of $1 = 0$ so the repercussions outlined in point (4) of Dr. Reiss' letter are no longer relevant objections. Also in answer to point (5) my reason for using logarithms is to make the x-axis data more managable.

Finally, using the standard formula for the coefficient of correlation (r) and using the x-axis values as 1 second for energy; 12 minutes for oxygen; 2 days for water; and 66 days for food based upon the sad death of a hunger-striker, then using the same time parameters as printed in Table 2 of my article, $r = 0.9997$.

Even when Dr. Reiss' suggested values of 18 days for water and 94 days for food are substituted for the ones mentioned above, then $r = 0.9909$.

In order to ward off endless correspondence over survival period parameters, I wish to emphasize one statement in my article:

'Even doubling the survival period of one factor and halving that of any other cannot alter their order of priority.

Gerald Duffett

# Withycombe Barton Christian Field Study Centre
# Exmouth, Devon

David J. Rivers and David J. Tyler

Withycombe Barton Christian Field Study Centre is officially open as from Saturday, May 22nd, 1982, Dr. Gary Parker of the Institute of Creation Research (U.S.A.) being present at the opening ceremony.

## Centre with a difference

Withycombe Barton has been conceived as a Christian Youth Centre with a difference. The vision is to help young people to appreciate the beauty and wonder of the world around them, and to recognise the evidence of God's handiwork. Being a field study centre, emphasis is placed on the development of practical skills by observation and experimentation. The Centre has its own grounds and good access to the surrounding countryside, enabling a wide variety of activities to be pursued. John Cunningham of Haldon Court, Exmouth, has taken the initiative to provide this centre for the use of Churches, Youth Groups, Schools and other organisations. In a society where the natural sciences are dominated by humanistic philosophy, Mr Cunningham desires that the Centre be used to help young people to think through scientific and Biblical principles relating to the world around them.

Withycombe Barton is a 150 year old farm house. Alongside is the main accommodation, lecture rooms, games rooms, common rooms, kitchen, coffee bar and warden's flat. These are sited in the redeveloped outhouses and barns which form a quadrangle next to the farm house. Much time and effort has been devoted to improving the property whilst retaining all the features and architectural attractiveness of the old buildings. The average group that can be accommodated is 35, with a maximum of 50, including leaders.

## Historical Past

The site of Withycombe Barton farm house is mentioned in the Doomsday Book of 1086 and historical records go back even further to Saxon times. There are famous names linked with Withycombe Barton Manor, such as the Raleigh family, which is commemorated in the nearby St. John's Church of England, and also the Drake family.

## Beautiful Surroundings

Withycombe Barton is set in an area of natural beauty. It includes twelve acres of its own ground, which incorporates a pond, an orchard and a stream. The surrounding countryside abounds with a wide variety of wild life including wild deer. There is plenty of woodland nearby on Woodbury Common. The Exe estuary is rich in birdlife and the seashore is sandy with some rock pools. Also nearby there are horse riding facilities, fishing in the river and the sea, and swimming can be arranged in the heated pool in the Haldon Court Christian Hotel in Exmouth.

## Courses and Use

It is intended to appoint a warden to initiate courses and to co-ordinate the varied work of the centre. Christians who have interests in the natural sciences are encouraged to consider how they might use these facilities. The scope is immense! Whilst emphasis is expected to be given to Christian perspectives in botany, zoology, ecology and the earth sciences, there is no reason why this Centre should not be used on as wide a basis as possible, for the benefit of both Christians and non-Christians. Thus, attention may be given to all the areas of human values, standards, behaviour, hopes and aspirations. As a study centre, Withycombe Barton may be used to present a much needed Christian alternative to the godless materialism of today's society.

### A Great Opportunity

Withycombe Barton aims to provide a service to Christian parents, pastors and teachers, youth leaders and specialist organisations. We believe that this venture deserves the prayerful interest and active support of the Churches. If you would like further details, please write direct to Withycombe Barton Christian Field Study Centre, St. John's Road, Exmouth, Devon, EX8 5EG. (Tel. 03952 3786)

### A BCS study-week for young people?

The writers have the following proposal to make to BCS members. That BCS organises a study-week for young people in the summer of 1983!

The general plan is that mornings are spent in lectures and seminars, afternoons in field and laboratory work, and evenings are for Bible ministry and relaxation.

We encourage response from anyone who is interested. We would like to hear from teachers who are willing to take responsibility for organising the programme for one or two days; from parents, youth leaders and pastors who know young people who would benefit from the study-week, and from any interested young people.

We believe that these are exciting days, and that ventures of this kind will, under God, do much good. It is our prayer that Withycombe Barton will become a centre of national importance in the Church's ministry to young people.

## Ape-Men: Fact or Fallacy

The first edition of this volume by Malcolm Bowden was referred to by Sylvia Baker in her Biology Book listt (**BC 4**: 11 p. 29). The second enlarged edition is now available. This gives thorough coverage to the discoveries made by Richard Leakey and Don Johansen, and to the Laetofil footprints. Francis Hitching (see book reviews section) describes Bowden's work as 'the best creationist book on the subject'.

DCW.

# GOD'S REVELATION IN NATURE

## A Study In *Romans* 1: 18-21

**David Watts**

The starting point of historic Christianity is the fact that God has spoken. He has revealed himself in the course of history to particular people in preparation for his full disclosure in Jesus Christ.[1] The Bible is God's inscripturated Word. And the Scriptures unfold the true meaning of his redemptive acts. This mode of divine communication to man has become known as special revelation.[2] It is of paramount importance. By this means men and women come to a life-transforming knowledge of God as redeemer.[3]

Alongside the primary consideration of special revelation, Christian theology has also been concerned with the problem of *general* revelation.[4] That is to ask, Is there a 'knowledge' of God which is manifest towards all men, apart from the means of special revelation? And if so, what is the *content* and *function* of this 'knowledge'? What are the *media* through which it is channelled? And what are the characteristics of *man's response*? These questions have been pondered by numerous theologians and philsosphers and many divergent opinions have been expressed.[5] Nevertheless it has been a widespread practice to speak of natural revelation, meaning general revelation through the medium of the natural world.[6] Consequently this issue is relevant to the contemporary debate about creation. Many people have attempted to explore this matter by starting from some philosophical or scientific basis. It is our purpose, however, to evaluate these questions from Scripture, and specifically from certain Pauline statements. The Bible refers to 'natural revelation' and these pronouncements are both informative and authoritative. When attention is given to exegesis of the relevant biblical material the subject may be seen in clearer perspective.

### Under God's Wrath

> *"The wrath of God is being revealed from heaven against all the godlessness and wickedness of men who suppress the truth by their wickedness."* (*Romans* 1:18, NIV)

The most detailed New Testament pronouncement on the subject of natural revelation[7] is contained in the first main section of Paul's epistle to the Romans. In v. 17 of *Romans* 1, Paul announces the great theme of his epistle, the good news of a 'righteousness from God' which has now been revealed to men and women through Jesus Christ. To those whose reponse is trust in and submission to Christ, the 'good news' proves to be the powerful means of their restoration to a right standing with God (v. 16). However, those who remain unbelieving are exposed to God's wrath,[8] his personal displeasure with and punishment upon their disobedience and rebellion. Accordingly there is a direct link between the theme announcement of v. 17 and the development in 1:18—3:20 of the sombre background to the Christian message. Paul's intent is firstly to demonstrate the universal sinfulness of mankind (3:23) and thus to show the universal human need of salvation in Jesus Christ (3:19f). This world-wide reference of Paul's argument here is the basis for concluding that God's revelation *in nature* is directed towards all men without exception.

Paul's discussion in *Romans* 1 is structured with constant allusions to the narrative of the early chapters of *Genesis*, and the figure of Adam evidently stands somewhere in the background.[9] This is the ultimate basis for the universal reference. This does not exlude, however, some specific application of Paul's argument to local conditions in the first century. The particular situation of the Gentiles was certainly in view, especially as exemplified in the Roman world.[10] Thus generalising slightly, *Romans* 1 has a very direct bearing upon the culture of Western civilisation, both in the first century and today.

## Confronted by God

> *"Since what may be known about God is plain to them,*
> *because God has made it plain to them.*
> *For since the creation of the world*
> *God's invisible qualities — his eternal power and divine nature —*
> *have been clearly seen,*
> *being understood from what has been made,*
> *so that men are without excuse.*
>
> *For although they knew God,*
> *they neither glorified him as God nor gave thanks to him,*
> *but their thinking became futile*
> *and their foolish hearts were darkened."* (*Romans* 1:19-21 NIV)

This section has two principal themes. Firstly God has confronted men by a general revelation of himself, so that we are inexcusable for ignoring God and going our own way. Secondly, man now has a nature which rebels against this revelation. The consequences of this state of affairs occupy Paul for the remainder of the chapter.

The *content* of natural revelation described generally in v. 18 as 'the truth' and in v. 19 as 'that which can be known of God',[11] is defined carefully in the following verse 20, to which we now turn. Gärtner observes that 'the attempt to arrive at the real meaning of this verse has led to much cudgelling of the brain.'[12] The verse consists of a basic statement concerning the *perception* of general revelation. To this several modifying words and phrases are attached which emphasize and elucidate the clarity, continuity, media, content and function of this revelation.

## 1.Perception

A 'communication' can be considered from several perspectives, namely those of the Sender and the Receiver and also that of the inherent message content.[13] Paul again refers to the fact of God's revelation in nature from the standpoint of the *human* receivers.[14] 'God's invisible qualities . . . have been seen'.[15] This paradox of invisibility/visibility is evidently deliberate to indicate that the reality of God, which is imperceptible to the physical senses — especially sight, is nevertheles apprehended by man. However, the paradox is resolved in the context, as the passive participate *nooumena*[16] ('being understood') immediately precedes the main verb *kathoratai*[17] ('clearly seen'). This highlights the role of some form of human intellectual capacity [18] involved in man's perception of the invisible God. There are several apparent possibilities here and it is worth engaging in further analysis so as to grasp Paul's exact meaning.

The verb *kathoratai* occurs nowhere else in the New Testament and hence the question arises as to whether it here retains its primary Septuagint Old Testament meaning[19] of *physical* sight. That is, *sense* perception. The main alternative is that the meaning of *kathoratai* is so governed[20] by the preceding participle that an intellectual process must be in view *overall*. This question depends partly upon the relative sequence of actions denoted by the two verbs. Grammatical considerations however point to their being simultaneous,[21,22] and exclude the concept of 'sense perception followed by a process of rational deduction'.[23] Moreover the context suggests that the 'understanding' resulting from God's revelation in nature is 'not by rational deduction but existentially and immediately'.[24] It is something characteristic of all men and women irrespective of intellectual ability.[25] Consequently the interpretation of *kathoratai* as denoting sense perception (physical sight) may still be admissible,[26] despite its rejection by many.[27] Certainly reference to the physically visible universe is introduced by the adverbial clause referring to the media of natural revelation. In conclusion, Paul has affirmed that the revelation of God disclosed to man is nature in indeed perceived by the human mind. Men and women 'see with the understanding', and thus have deep down some awareness of God however hard they try to suppress this knowledge.

## 2. Clarity

It might have been thought that God's general revelation would be but dimly perceived. However, stress is laid upon the clarity or perspicuity of this disclosure; these things are clearly seen (*kathoratai).*[28] The preposition *kata* has the force of intensifying the verb 'to see' *(oraō).*

## 3. Continuity

The phrase *apo ktiseōs kosmou* should be understood, with the preposition *apo* having a temporal sense,[29] to mean 'since the creation of the world'. There are two reasons for this conclusion. Firstly, the word *ktisis* refers primarily to the act of creation, rather than to the product(s) of that act. Secondly, the idea of the instrumentality or media of general revelation is sufficiently expressed by the phrase 'from what has been made', which follows. An additional statement to this effect would be redundant.

The manifestation of God's invisible qualities thus commenced with the absolute beginning of creation and has been continuous ever since.[30]

## 4. Media

What are the media through which God manifests his invisible qualities? Paul informs us comprehensively that this is 'by the things made', *(tois poiēmasin).* In the LXX Old Testament *poiēma* has a general reference to the deed and actions of God and man. These include God's dealings in the history of nations, in the life of the individual and in nature. Accordingly a very general reference may be admissible here to all God's works, to everything that can bear witness to God.[31] Nevertheless in this context, following the explicit reference to God's creation, the specific sense of 'things made' should be given primary emphasis.[32] This is in harmony with the only other Pauline and NT occurence of *poiēma,* in *Ephesians* 2:10.

## 5. Content

The content of general revelation is defined precisely as 'God's invisible qualities — his eternal power and divine nature'. This tells us something about the attributes of God. Thus the content of general revelation is concerned with aspects of God's character rather than with 'proof' of his existence.

The first mentioned attribute is God's invisibility.[34] The perception of this quality in God ought to rule out the making of visible representations. Paul thus proceeds in the following passage to a three-fold accusation of the gentiles' error in materialising the deity.[35]

The attribute 'eternal' *(aidios)*[36] syntactically qualifies both the predicates 'power' and 'divine nature', and affirms the underived, uncreated self-existence of God. This is another typical biblical mode of expressing the Creator/creature distinction. The 'power' *(dunamis)*[37] of God, qualified as eternal, points specifically to his almightiness or omnipotence. This God who discloses his almighty character in nature, whether in the thunderclap or the mighty waves of the sea, altogether transcends the limitations of man's idols. God's 'divine nature' or 'divinity' *(theiotēs)* refers in an abstract and generic manner to all the perfections that distinguish him from the cosmos. The word is used in the NT only here, the meaning being established from Septuagint usage and from NT occurrences of cognate terms.[38] The Old Testament had mentioned other attributes of God as being displayed in his visible handiwork. It is thus likely that by 'divine nature' Paul includes the thought of God's wisdom, goodness and righteousness.[39] The clear statement of the apostle in this passage is that God's handiwork makes manifest the invisible perfections of God as its creator. Using the terminology of Immanuel Kant,[40] but to affirm what Kant denied, Murray paraphrases Paul: "Phenomena disclose the noumena of God's transcendent perfections and specific divinity".[41]

The reference in v. 18 to God's wrath 'being revealed' shows that wrath should also be included in the content of general revelation. However, the statement concerning wrath stands contextually apart from the references to the other revealed attributes. In particular, Paul does *not* say that God's wrath has been revealed to mankind *ever since the creation of the world.* In fact wrath was not manifest towards mankind until the event of Adam's primaeval transgression (*Romans* 5:12 ff). Nevertheless Paul subsequently affirms that the judgement of God is manifest in various ways,[42] including the tangible event of physical death. Moreoever Paul speaks of the sub-human creation now 'subject to frustration' and in 'bondage to decay' (*Romans* 8:20 f). The natural world-environment, which thus mediates general revelation to mankind, should be considered in terms of three temporal stages.[43] Prior to the transgression of Adam, there was a period free from sin and death. Now we live in an era where these evils are present; nature is abnormal in certain aspects, 'red in tooth and claw'. And so we await the final eschatological state when 'the creation itself will be liberated . . . '. It is therefore in the present epoch that God's wrath is manifest as an additional facet of natural revelation.

### 6. **Function**

What is the function of general revelation in God's relationship with mankind? By this means God discloses to us truth concerning his attributes yet this falls short of providing for our needs of redemptive knowledge. Otherwise the fuller detail of scriptural revelation would be unnecessary. In fact the answer to our question is given at the conclusion of Paul's main statement in v. 20 "... so that men are without excuse".[44] As expressed here in the NIV rendering this is a *result* clause, stating the consequence of God's self-disclosure in nature. A good case can also be made for interpreting the expression as a *purpose* clause[45]: "... *in order that* men may be without excuse". Either way, however, it is the function of this revelation that man is rendered inexcusable before God whenever he turns his back upon the rudimentary knowledge of the Creator which is available through nature. J.H. Bavinck relates this function to that of bringing a sense of shame. He sees this as an essential ingredient in the missionary proclamation of the church and terms this aspect Elenctics.[46] This note is again sounded in *Romans* 3:19 as Paul concludes his indictment of a guilty world.

### Man's response: suppression of the truth

God's self-disclosure in creation is as clear as the noonday sun. But men have sought to turn away from the light which surrounds them on every hand. Undoubtedly Paul regards this rejection of God's revelation as a consequence of Adam's primeval transgression. In every generation since that time men have sought to hide from the face of God. They "... suppress[47] the truth by their wickedness" (v. 18). According to v. 21, men 'know' God — yet 'they did not think it worthwhile to retain the knowledge of God', (v. 28). These statements perhaps suggest that the word 'know' is being used in a somewhat lower sense here than in the primary biblical usage where knowledge entails personal relationship. Although men clearly perceive God's self-disclosure yet in constantly seeking to suppress this knowledge this has brought about an ultimate futility to unrenewed human reasoning, and 'darkness' upon the centre of men's personalities (v. 21).[48] These charges are repeated by the apostle in *Ephesians* 4:17 ff and are in line with his statement to the Corinthians that " ... the world through its wisdom did not know God", (1 *Cor.* 1:21). [48]

### Natural Revelation and Theological Controversy

The classic Pauline statements on natural revelation have given rise to many questions and extensive discussion. Some of these matters have been touched upon in the foregoing exegesis. It remains to briefly survey some of the key issues.

**(i)** Among biblical scholars there has been debate over the originality of Paul's affirmations since he has used technical terms employed in Hellenistic philosophy and because of suggested literary parallels from this *milieu.* Among the latter are *Wisdom* 13:1-9 from Hellenistic Judaism. With regard to Stoic technical vocabulary, Gärtner[50] concludes his careful discussion with the following observations. Firstly, the words *phaneroun* (manifest), *poiema* (things made) and *ktisis* (creation) belong to a biblical tradition whose principles are opposed to the doctrines of Greek philosophy. Secondly, the terms *aoratos, nous, nooumena* and *kathoratai* are Hellenistic, but they have not given Paul's thought any philosophical bias.

Obviously, Paul was not the first person to discuss the question of the knowledge of God in relation to the natural world. His statements, however, are a definitive NT pronouncement upon the subject.

**(ii)** The next set of questions concern the place of *Romans* 1:19-21 in the overall structure of Pauline and NT Theology. We have noted that v. 19-21 are compatible with the teachings of 1 *Corinthians* 1-2. Unaided human reason (the 'Wisdom of this world') cannot attain to the knowledge of God. All such knowledge is dependent upon submission of the mind to either general or special revelation. Consequently there is essential harmony between Paul's teaching in *Romans* 1 and the statement of *Hebrews* 11:3: *"By faith* we understand that the universe was formed at God's command . . . " Faith is neither more nor less than a positive response to divine disclosure. It is believing God. Given the opportunity of discussion, Paul and the Author of *Hebrews* would doubtless have agreed on the following points:
(1) The true acknowledgement (albeit hypothetical) of God as Creator on the sole basis of natural revelation would entail a human 'faith' response to that revelation.[51]

(2) Since special redemptive revelation has now become necessary, true faith in God *as Creator* entails positive response to "Scripture *in conjunction with* natural revelation". Thus, for example, the renewed Christian mind acknowledges God as Creator of the sun, moon and stars because we believe God's word in *Genesis* which informs us of this fact and because these entities to which the Scriptures refer are perceived directly.[52] It follows that while Scripture is now essential to faith in God as Creator, *men who are without Scripture are nevertheless culpable, if they do not acknowledge the Creator,* since the light of general revelation is sufficient to render them inexcusable. This is of obvious importance in Christian proclamation to the world as seen in the

structure of Paul's argument in *Romans* 1-3. A later example of the importance of this topic in evangelistic theological writing may be seen in Calvin's *Institutes,* book I, where he speaks at some length of the *Divinitatis sensum* which God has implanted in all men and of the 'innumerable evidences both in heaven and on earth that declare his wonderful wisdom', (5:2).

In the 20th Century, Christian thinkers such as Cornelius Van Til and Francis Schaeffer have both seen the importance of God's natural revelation for the defence and proclamation of the Christian faith. It is well known, however, that Karl Barth generally rejected the notion of natural revelation, despite its acceptance by his colleague Emil Brunner.[53] Barth's opposition to natural revelation seems to stem from some confusion with natural theology and especially from the Kantian categories which influenced his conceptualization of divine revelation and 'knowability'.

**(iii)** The earlier analysis of perception of general revelation has demonstrated that this is *not* a matter of human deductive or inductive reasoning working on the data of creation. Rather it is a case of an immediate, existential awareness of the Creator, as manifest in his handiwork. It follows that the natural theology of Thomas Aquinas is quite unbiblical. Aquinas assumed that man's reasoning working on the data of nature can build up by the five classic 'proofs' a coherent and, as far as it goes, entirely correct view of the existence, nature and attributes of God. The first part of his *Summa Theologica* is grounded on human reason alone and this is never modified or corrected subsequently in the light of Scripture. Quite apart from the devasting criticisms of Hume and Kant[54] this whole approach is precisely what Paul is concerned to deny. Man's autonomous thinking has become fultile (v. 21 ff). As distinct from the clear disclosure of general revelation, natural theology has become simply man's ideas on God; ideas which are in some measure depersonalized and degraded.

Another tendency related to the programme of natural theology, is to make a false indentification of general revelation with natural science. Granted these both have a relation to the creation; but there the similarity ends. Although natural revelation has been continuous since the creation of the world, Paul gives not the slightest hint that its content has increased in scope or depth. On the contrary human scientific knowledge, though fallible and corrigible, has increased in quantity especially with regard to presently-operating processes.

**(iv)** Having denied the validity of natural theology it remains to suggest a total *inversion* of the classical teleological or design argument so that it becomes more in keeping with the Pauline and NT view of the primacy of revealed truth. Rather than arguing with Aquinas, Paley, *et al.* from design to a Designer, we argue from the Creator/Architect/Designer to design in the universe. This *Inverse Teleological Argument* is based upon the certain knowledge of God's existence and character as manifest jointly and objectively in special and natural revelation and known subjectively through the witness of the Holy Spirit. The argument is thus revelational rather than rationalistic or empirical in character. The inference *from* the Creator *to* design in the universe is based on the human designer/design analogy. This should be justifiable on a biblical basis from the creation of man in the image of God. Since the argument begins from the fully biblical presentation of God as self-existent Trinity, almighty, dynamically active — the living God, the reductionistic and deistic tendencies of the classic teleological 'proof' should not mar this very different approach to the study and recognition of design characteristics in the structure and dynamic functioning of the created world.

When design characteristics are recognised in the universe this does not necessarily make mechanistic interpretations redundant at the scientific level. Recognition of design in particular instances, however, would serve to illustrate, not the 'proof', but the *coherence* of biblical Christian theism. Further consideration of design characteristics and the inverse teleological argument will be deferred to a subsequent publication

**(v)** Finally we must emphasize the close correlation between natural and special revelation for the Christian. The renewing of our minds leads to a fresh appreciation of the wonder and grandeur of the natural world. With G.W. Robinson we know:
*"Something lives in every hue/Christless eyes have never seen".*
In the preface of the Bible published by his cousin Pierre Olivétan, John Calvin writes of God's revelation in nature in a passage of lyrical beauty:

> 'In every part of the world, in heaven and on earth, he has written and as it were engraven the glory of his power, goodness, wisdom and eternity . . . For all creatures, from the firmament even to the centre of the earth, could be witnesses and messengers of his glory to all men, drawing them on to seek him and, having found him, to do him service and honour according to the dignity of a Lord so good, so potent, wise and everlasting; they were even helping each one in his place upon

> that quest. The little singing birds are singing of God: the beasts cry unto him, the elements are in awe of him, the mountains echo his name. Waves and fountains glance at him, grass and flowers laugh out to him. So that in truth there was no need to seek him afar, seeing that everyone could find him within himself, inasmuch as we are all sustained and preserved by his virtue abiding in us.'

How far this is from the barren speculations of the natural theologians and deistic philosophers!

## Conclusion

The contemporary debate on creation often raises questions that have been discussed in earlier times under the headings of 'natural revelation' and 'natural theology'. We should be informed about earlier thought and studies and yet avoid the mistakes of the past. Paul's teaching in *Romans* 1 offers no support for the notion of natural theology. Nevertheless, there is a genuine doctrine of natural revelation, which has a clearly prescribed function. In relating this theme to the data of the natural sciences the *Inverse Teleological Argument* approach is recommended.

## Notes

1. *Hebrews* 1:1-2 is the classic statement of this fact.
2. For a reliable introduction see, R.M. Horn, *The book that speaks for itself.* Inter-Varsity Press, London (1969).
3. J.I Packer explains these crucial issues in *I want to be a Christian,* Kingsway Publications, Eastbourne (1977).
4. Standard discussions include G.C. Berkouwer *General Revelation* Eerdmans, Grand Rapids (1955) and — most recently — Bruce Demarest, *General Revelation: Historical Views and Contemporary Issues,* Zondervan, Grand Rapids (1982).
5. A good survey is also given by C. Brown, *Philosophy and the Christian Faith,* Tyndale Press, London (1969).
6. So, for example, by R.T. France in *The Living God,* Inter-Varsity Press, London (1970) p. 29-36. Natural revelation should be carefully distinguished from 'Natural Theology' — the various futile attempts at man-centred logical 'proof' of the existence of God on the basis of certain general premises about the character of the natural world. In natural revelation, the movement is from God to man; in natural theology, from man to 'God'.
7. Further classic statements occur in the *prologue* to the Fourth Gospel, (*John* 1:4, 5, 9). Cf *Acts* 14: 15-17 and *Psalm* 19:1 f
8. God's wrath is preeminently reserved until the eschatological day of judgement (*Romans* 2:5). However, the final day of wrath is adumbrated by God's judgements within the present course of history (1:18, 24, 26, 28).
9. For discussion, see M.D. Hooker, *New Testament Studies VI* (1959-60) p. 297-306; A.J.M. Wedderburn, *Studia Biblica* (1978) III p. 413-430; and J.D.G. Dunn, *Christology in the Making,* London SCM (1980) p.101-5.
10. Most commentators accept the particular application to the Gentile World — in F.A. Schaeffer's phrase, an application to "the man without the Bible," (*Death in the City.* IVP, 1969 p.79 ff). The 'Gentile' reference extends through Chapter 1, and possibly as far as 2:17, where the Jewish people are specifically addressed. In 3:9 ff Paul sums up his charges against both Jew and Gentile.

11. *to gnōston tou theou*
    H.P. Owen (NTS V (1958-9) p. 133-143) artificially restricts the content of natural revelation to those attributes of the Divine Being which are discussed in pagan literature as well as *Romans* 1:20.
12. B. Gärtner, *The Areopagus Speech and Natural Revelation,* Almquist and Wiksells, Uppsala (1955) p. 133.
13. D.C. Watts: "Creation, Communication and Linguistics" in *Focus On Creation* (Rainbow Press, Derby, 1978) p. 35-41. See further, Vern S. Poythress: "Analysing a Biblical Text: Some Important Linguistic Distinctions". *Scottish Journal of Theology 32,* 113-117 (1979). Basic to all divine/human communication is the fundamental biblical distinction, within existing reality, between Creator and creation, (C. Van Til, *The Defense of the Faith,* Philadelphia, P.R.P.C. (1972) p. 23 ff).
14. cf. vv. 19 and 21 a
15. *ta aorata autou . . . kathorarai*
    Compare the word-play (oxymoron) with that in (pseudo) Aristotle: *De Mundo* 399b, 14 ff: *aoratos tois ergois horatai.*
16. *nooumena* is the present passive participle (neuter plural nominative) of *noeō* (apprehend, perceive, understand, etc. — N I D N T T III p. 122 ff; T D N T IV p. 950).
17. *kathoratai* is the present *passive* indicative (third person singular) of *kathoraō,* '(clearly) seen' or perhaps 'cause themselves to be clearly seen' (if the passive is to be understood in the sense described in B D F § 314).
18. For an excellent summary of the Pauline concept of *nous* ('understanding, mind') see H.N. Ridderbos *Paul: An Outline of his Theology,* Eerdmans, Grand Rapids (1975) p. 117-119. " . . . *nous* on the one hand denotes the possibility, in which man is addressed as a thinking and responsible being by the revelation of God, and on the other constitutes as well the description of that by which he is most deeply determined in his thinking and acting".
19. *kathoraō* occurs 4 times in the LXX. Sense perception is indicated at *Num* 24: 2 and *Job* 39:26 (and by *kateidon* at *Ex* 10:5). T D N T V p. 379..
20. An alternative understanding of the syntax has been advanced by A. Fridrichsen (*ZNW 17* (1916) p. 159-168). He takes the words *tois poiēmasin nooumena* together as a parenthetic paralled to, or closer definition of, 'the invisible things . . . are clearly seen', so that the passage would then run: "His invisible being is, to the reasoning mind, visible in his works ever since the creation of the world". As Gärtner observes, this would mean that Paul was formulating with utmost clarity the popular idea of natural theology. (*op cit.* p. 134). In criticism, it should be noted that in Fridrichsen's translation the passive *nooumena,* is treated as if it were in the active (so, '(actively) reasoning mind'). Moreover Fridrichsen attributes to Paul the philosophical view that man's nature is akin to God so that the word *nooumena* in v. 20 refers to man's divine *logos.* However, Paul never hints in any of his letters than man's mind (nous) is to be understood in the sense of characteristic of the *logos* — theology of the philosophers. Neither does Paul express any wish to prove God's existence in *Romans* 1. His aim is to make clear something of the character and attributes of God.
21. "The conjunctive participle is used most frequently to indicate the manner in which action takes place, what precedes it and what accompanies it (modal and temporal), "B D F § 418 (5). This excludes the possibility of the participle action following that of the main verb (T D N T, V p. 380).
22. S. Greijdanus (*Commentary*) has suggested that the participle *nooumena* has a conditional sense. The meaning would then be 'the invisible things . . . are clearly seen, *if one thinks back*". However, a conditional sense seems unlikely in view of the certain 'knowing' of vv. 19 and 21. Moreover this also entails mental reflection *subsequent* to the 'clearly seen', which is disallowed grammatically.
23. Such would be the meaning required in support of the Thomistic concept of natural theology.
24. Thus E. Käsemann (*Commentary* p. 42) and M.D. Hooker (*NTS* VI (1959-1960) p. 299).
25. The knowledge involved is essentially a form of 'tacit knowledge' in the sense defined by M. Polanyi, (*Personal Knowledge,* R K P, London (1958)).
26. So, FF Bruce (Tyndale Commentary p. 84) and many other commentators. Cranfield (I C C I p. 115) however, refers both *nooumena* and *kathoratai* to physical sight!

27. eg. W. Michaelis (T D N T, V p. 380).
28. C. van Til points out that the perspicuity of natural revelation depends upon the fact that it is an aspect of the total and totally voluntary revelation of a God in complete control of his world. ('Nature and Scripture' in *The Infallible Word,* Philadelphia, P R P C, 1967).
29. *apo* has a temporal sense in the following occurrences of the same expression. *Mt* 24:21; 25:34; *Mk* 10:6; 13:19; *Lk* 11:50; 2 *Pet* 3:4; *Rev* 13:8; 17:8.
30. The present tense in v. 19: *phaneron estin* also confirms the continuity of natural revelation.
31. B. Gärtner, *op-cit* p. 138.
32. So, Cranfield (ICC) p. 115 n2.
33. *ta aorata . . . ē te aidios autou dunamis kai theiotēs.* The longer phrase is in apposition to 'the invisible qualities'.
34. Compare the following NT references to the invisibility of God: *Jn* 1:18; *Col* 1:15; 1*Tim* 1:17; *Heb* 11:27.
35. Their idolatry has rendered 'visible' God's invisibility (v. 20, 23, 25); God's incorruptibility has been turned into something corruptible (v. 23) and the Creator has been confused with the creature (v. 25).
36. *Aidios* occurs in the LXX only in *Widsom* 7:26 and in the NT only here and in *Jude* 6. The usual word for 'eternal' is *aiōnios.*
37. *Sometimes hē dunamis* was used as a periphrasis for the divine Name (*Mt* 26:64 = *Mk* 14:62).
38. In the LXX at Wisdom 18:9; a Hellenistic term denoting the divine nature and properties. The cognates *theotēs* 'deity' occurs in *Col* 2:9 and *to theion* in *Acts* 17:29. See further H.S. Nash in *Journal of Biblical Literature 18* (1899) p. 1-34.
39. Don Richardson has adduced evidence from anthropology of extensive tribal memory of traditions of a Supreme Creator. This may be in part the dim recollection of *special* revelation. (*Eternity in their hearts,* Gospel Light Publishers, London, 1982).
40. Noumenon is Kant's alternative term for a *thing-in-itself,* which we could never be acquainted with, or even in any way know what it was like! But Kant thought that noumena must be postulated to account for the appearances (phenonena) we are confronted with. (*Critique of Pure Reason)* A.R. Lacey. *A Dictionary of Philosophy,* London, RKP (1976).
41. J. Murray (*Commentary*) p. 40.
42. God is said to give men over to their evil desires (vv. 24, 26, 28).
43. D.C. Watts: 'Nature's Bondage and Deliverance' BC *3:*10 (1981) p. 76-87.
44. *eis to einai autous anapolgētous*
45. See J. Murray (Commentary) p. 40 n 39.
46. *'An Introduction to the Science of Missions'* (trans. D.H. Freeman) Philiadelphia, PRPC (1960) p. 221-272. The term was originally coined by Abraham Kuyper. See also, D.J. Hesselgrave, *'Communicating Christ Cross-Culturally'* (Zondervan, Grand Rapids, 1978) p. 413-423.
47. *katechontōn.* The present participle is probably intended in its sense of 'suppress' or 'hold down', rather than 'hold fast'.
48. *Kardia* ('heart'). This is one of Paul's most important psychological terms and has a wide range of use. It is not necessarily good (1:24; 2:5) nor is it necessarily evil (2:15; 5:5; 6:17). It is the organ of thought (10:6) and of feeling (9:2). It is essentially inward and hidden (2:29; 8:27).
49. Paul's argument here relates to man-centred human philosophy rather than natural revelation.
50. *op. cit* p. 144
51. Ultimately 'perception' (*noeō*) is dependent upon 'faith' (*pistis*). Moreover, in *Hebrews* 11:3 the writer also declares that faith in creation, involves rational perception (*nooumen*). There is a further similarity with *Romans* 1:20 in the statement that the perceptible creation (*to blepomenon*) did not come into existence from things that are visible (*mē ek phainomenōn*).
52. C. Van Til ('Nature and Scripture' *op. cit.*) discusses the interaction between natural and special revelation in detail.
53. For a full discussion see G.C. Berkouwer *op. cit.* p. 21-57.
54. C. Brown *op. cit.* p. 66 ff; 97 ff.

# THE SIGNIFICANCE OF EDITING MECHANISMS IN BIOLOGICAL INFORMATION TRANSFER

Grant R. Lambert

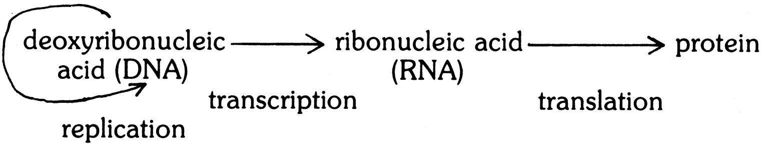
> *". . . . . that the Creator made things to run quite well without his having to step in constantly by direct intervention is more of an indication of design and infinite wisdom than if we could see him physically at work in some visible form adjusting the machinery of nature."* [16]

## A. Information Transfer in Biological Systems

Two words per second with an error rate of $10^{-2}$ is reckoned to be a good rate of information transfer by a typist.[1] Compare with this the performance of enzymes involved in deoxyribonucleic acid (DNA) replication in the bacterium *Escherichia coli*, which copy 1,700 base pairs per second[2] with an error rate as low as $10^{-10}$.[3]

This is but one example of the remarkable processes of information transfer which occur in living cells. Since Watson and Crick first produced a model of DNA structure, [4] revealing the way in which information can be built into this molecule, the pathway of information transfer in biological systems has been elucidated (Fig. 1).

Fig. 1. The 'Central Dogma' of Information Transfer.



Information can be passed from DNA to DNA (replication), from DNA to RNA (transcription) and from RNA to protein (translation). This pattern of information flow formulated by Crick[5] is referred to as the 'Central Dogma' (certain viruses were later found to make use of other ways to store, transfer and express genetic information, [6,7] requiring extension of permitted routes of information flow[8]).

## B. The Origin of Information Transfer

Two generalised schemes for the origin of information transfer can be envisaged:

*1. Chance*

Since certain kinds of design, such as crystals and wind-worn rock formations,[9] can be brought about by naturalistic processes without any designer being necessary, it is not unreasonable to consider the possibility that life itself could also have arisen by chance processes acting on matter. If this model were true, it should be possible eventually to provide a feasible sequence of complexification of matter to form life using existing chemical and physical laws.

*2. Intelligence*

Since other kinds of design, such as arrowheads and airplanes,[9] do imply a creative intelligence, the possibility that life is the outcome of intelligent design merits consideration. If this proposition were true, a satisfactory naturalistic explanation for life should forever elude the grasp of scientists.

It is clear that neither proposition rests on the existence of design *per se* , but rather, the kind of design that is observed, whether it implies time and chance or intelligence.

### C. Assessing the Two Propositions

Arguments for a chance or intelligent origin for life have come from three main areas. *First,* on an experimental level, a considerable literature exists describing the formation of basic chemical constituents of life under simulated primitive earth conditions.[10-14] The impressive achievements of workers in this field are considered by some to provide strong evidence for a chance origin of life. [13,14] Others have pointed out how far short of a living system possessing orderly mechanisms such attempts fall.[15,16] The implications of intelligent design employed in such experiments, for example, in preventing product degradation by the inclusion of 'traps', [11, 12;] also merit consideration.

*Second,* on a theoretical level, detailed probability analyses have been performed to assess the likelihood of life being produced by chance.[16, 20] Most studies have concluded vanishingly small probabilities, even in all the fullness of time.

*Third,* on a conceptual level, the complex batteries of interdependent enzymes involved in information transfer must be reckoned with. For example, of the first step in DNA replication, initiation, Szekely[2] writes 'This is probably the most complex step in replication, requiring the coordinated action of 6 to 10 proteins in different systems.' Of the overall replication process, she[2] writes '. . . the actual enzymic mechanism, the many individual steps involved in the synthesis of a new DNA molecule, is of great complexity. A great number of specific enzymes and protein factors are required, the carefully coordinated action of which brings about the fast and accurate transfer of genetic information from one DNA molecule to the other.' The interdependence of the enzymes and protein factors would appear to provide evidence for intelligent design: exploration of the minimum requirements for various steps in information transfer in cell-free replication, transcription and translation would provide more information with which to assess this argument.

In the present communication, it is intended to contribute to this third aspect by noting the implications of editing or proof-reading activities of various enzymes involved in information transfer.

### D. Editing Reactions in Information Transfer

As noted previously (part A), the overall processes of DNA replication and the transcription and translation of the message into protein are extraordinarily accurate (see Table 1 'observed error rate'). These observed error rates in information transfer imply a specificity of enzymes involved which is beyond the theoretical limits for simple enzymes.[3] From these limits, predicted error rates of such simple enzymes can be calculated (see Table 1, 'predicted error rate in absence of editing'). The reason for the occurrence of errors particularly in protein synthesis is that the building blocks from which proteins are constructed (amino acids) are generally so similar in their structure that distinguishing between them is extremely difficult. Although in DNA replication the size and shape of the different building blocks (the base pairs) are also very similar, somewhat greater accuracy is provided in this process (see Table 1 'predicted error rate in absence of editing') by basing the selection primarily upon the complementarity of base pairing rather than upon size or shape alone. Actual error rates in information transfer are normally measured *in vitro* under conditions which mimic those in the cell.

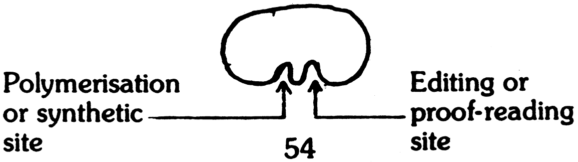
Table 1: Error Rates in Information Transfer *

| Process | Observed error rate. | Predicted error rate in absence of editing. | Increase in fidelity of process by editing. | Experimental evidence for editing? |
|---|---|---|---|---|
| Replication (DNA⟶DNA) | $10^{-8} - 10^{-10}$ | $10^{-4} - 10^{-5}$ | $\simeq 10^{3} - 10^{4}$ | Yes |
| Protein synthesis (DNA⟶protein) | $< 10^{-3}$ | $10^{-1} - 10^{-5}$ | $\simeq 10 - 10^{3}$ | Yes |

* Based on Table 2 of Ref. 3

The fact that observed error rates are much lower than predicted error rates in information transfer (see Table 1, 'increase in fidelity of process by editing') is explained by the presence of editing or proof-reading mechanisms.[3] In addition to their synthetic or polymerisation 'active site', certain key enzymes have a second, editing or proof-reading, site which is used to destroy incorrect intermediates as they are formed[3] (Fig. 2).

Fig. 2: Simplistic Representation of an Information Transfer Enzyme.

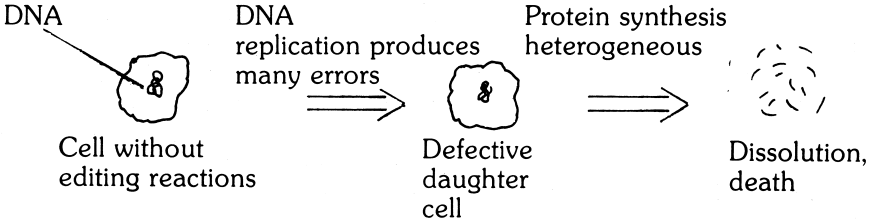

Polymerisation or synthetic site
Editing or proof-reading site

This is not only inferred from the discrepancy between predicted and observed error rates, but has been demonstrated experimentally in many instances (Table 1). For example, in DNA synthesis, DNA polymerase I was found by Brutlag and Kornberg[21] to possess an activity which removes mismatches as they are formed. Evidence for editing of amino acid activation by enzymes known as valyl-RNA synthetases was found experimentally by Norris and Berg.[22]

### E. Synthetic and Editing Activities are Necessary for Sustaining Information Transfer

An important implication of the predicted error rate in the absence of editing is that a cell lacking the editing reactions would be unable to replicate its DNA or produce protein with sufficient specificity for life to continue (Fig. 3).

Fig. 3: The Fate of a Cell Lacking Editing Reactions.



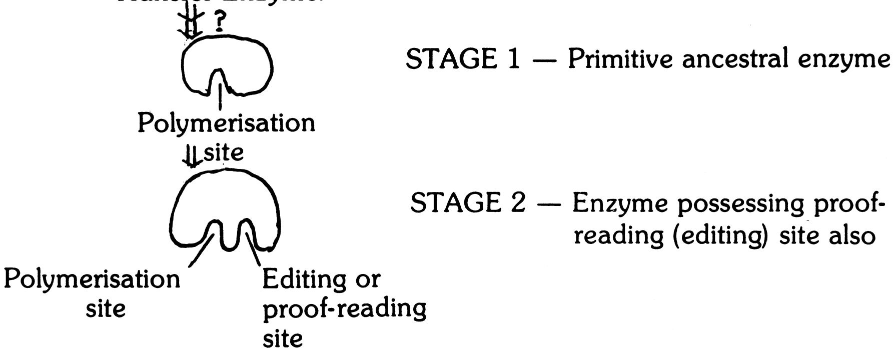
This is particularly the case since very few if any proteins, including those involved in information transfer, could tolerate the error rates in the absence of proof-reading to retain significant biological activity and specificity (necessary for the intricate process of cell division to produce viable progeny). As stated in an excellent review[3] on enzymic editing mechanisms, 'The exquisite fidelity of the genetic coding process is maintained during the replication of DNA and the synthesis of proteins by a series of editing or proof-reading reactions which remove errors. *Without these checks, mutation rates would be unacceptably high and proteins largely heterogeneous*'. (Emphasis added).

By example, Fersht[3] notes that a typical protein in *E. coli,* containing some 1,000 amino acid residues, would contain up to 100 incorrect amino acids in the absence of editing. He concludes that '... there would be few, if any, viable progeny per generation and those produced would be inefficient.'

### F. Constraints Imposed by Editing Reactions on Origins Scenarios

*1. Chance* — For a chance origin of life, the first enzymes involved in information transfer (leaving aside the question of their origin) would have to be crude, possessing only synthetic (polymerisation) activity (Fig. 4, stage 1). Later, selective pressures for greater specificity of information flow would result in the evolution of a second, editing or proof-reading, site for these enzymes (Fig. 4, stage 2).

Fig. 4: Hypothetical Chance Origin for Editing Mechanisms of Information Transfer Enzyme.


?
STAGE 1 — Primitive ancestral enzyme
Polymerisation site
STAGE 2 — Enzyme possessing proof-reading (editing) site also
Polymerisation site
Editing or proof-reading site

As we have already seen, however, (part E above), stage 1 would be untenable because mutation rates would be unacceptably high and any biological specificity of enzymes would rapidly be lost. Even if it were possible to produce one effective daughter cell, it would clearly not be possible to sustain replication and the various processes of information transfer without editing over a large number of generations (as would be necessary for the various enzymes involved in information transfer to evolve their elaborate editing mechanisms).

These considerations lead one to the alternative belief that the synthetic and proof-reading activities of enzymes involved in information transfer came into existence simultaneously.

*2. Intelligence* — In this model, enzymes involved in information transfer have possessed both synthetic and editing activities since life was first created. The editing activities could be regarded as inbuilt 'brakes' on genetic deterioration such that life is able to continue without 're-creation' being periodically necessary. As Fersht[3] has noted in a different context, in the absence of editing mechanisms 'the present system of genetic code and amino acids would certainly not be able to maintain the higher forms of life.' (Although the point is illustrated amply by the available data (Table 1), it might be further explored experimentally using mutants which are defective in only *one* of the many editing reactions, which may enable a more detailed evaluation of the significance of particular editing reactions).

## G. Summary

1. Information transfer in biological systems

$$\circlearrowleft \mathrm{DNA} \longrightarrow \mathrm{RNA} \longrightarrow \mathrm{protein}$$

is enabled at each step by editing or proof-reading reactions which remove errors.

2. In the absence of editing reactions, life could not be maintained because mutation rates would be unacceptably high and proteins heterogeneous.
3. Hence, information transfer and its accompanying editing reactions must have come into existence simultaneously (information transfer could not be maintained without editing reactions ).
4. This implies an intelligent origin for information transfer rather than a chance origin.

It is noteworthy that 1. is fact and 2-4 are implication and interpretation. The reader is invited to weigh carefully the arguments presented in the light of known error rates in information transfer. As C.S. Lewis once noted, "All possible knowledge . . . . depends on the validity of reasoning.'[23]

## Acknowledgement

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# REVIEW ARTICLE

*"A New Science of Life:* The Hypothesis of Formative Causation" By R.S. Sheldrake (1981), Blond and Briggs Ltd., London, 229 pp., £12.50.

Michael J. Reiss

## Introduction

"A New Science of Life: The Hypothesis of Formative Causationi" is the title of a recent (1981) book written by Rupert Sheldrake. Its scope is broad. As Newth[1] has written a review of the book in *Nature* "The title of this book is misleadingly modest. The author is not content to propose only a new science of life, for he reassesses many features of the real world that have been revealed by natural science, and proposes that there exists a great conservative principle making itself felt as much, or more, by sub-atomic particles as in developing embryos or in the behaviour of human beings." Put crudely, Sheldrake's argument is that things are more likely to happen again if they have happened before. This principle applies as much to chemical reactions as to human behaviour. Crystals of a new substance, it is argued, are easier to synthesize once some of them have already been made, even if in a different laboratory. Similarly it should be becoming easier and easier for people to learn to ride bicycles, or to type, or to swim, just because more and more people have already learned to do these things.[2]

If Sheldrake is right, or even partly right, then this is indeed a book of quite outstanding importance. Sheldrake is proposing a new law of nature at least comparable in importance to Newton's laws of gravitation, Maxwell's field equations, Darwin's principle of natural selection and Einstein's theory of general relativity. For most of the book Sheldrake expounds and defends his hypothesis of formative causation, but at the end he considers its theological implications.

## Sheldrake's Thesis

At present professional biology is almost completely dominated by materialism, the view that nothing exists except matter and that consciousness and will are wholly due to material agency. All the phenomena of life are considered to be explicable (in principle at least) in terms of physics. Sheldrake tells us that he used to accept the mechanistic paradigm, but that over a period of several years he came to find such a viewpoint unnecessarily restrictive. A semantic aside is necessary here. Sheldrake uses the word materialism in two senses: (1) "living organisms are nothing but complex machines, governed only by the known laws of physics and chemistry"; (2) "living organisms are regarded as physiochemical machines, and all the phenomena of life are considered to be explicable in principle in terms of physics and chemistry". As Sheldrake indeed proposes a new law of physics and chemistry, he is bound to reject materialism type (1). His attitude towards materialism type (2) is less definite, though perhaps of more interest to readers of *Biblical Creation.* I will return to it under the section "A Christian response."

Sheldrake details several areas in which he feels that the known physical laws are inadequate to explain certain biological phenomena.

**(1) Morphogenesis.**
Sheldrake quotes the definition of biological morphogenesis as the "coming-into-being of characteristic and specific form in living organisms". The first problem is precisely that form comes into being. New structures appear during ontogeny which cannot be explained in terms of the unfolding or growth of structures which are already present in the egg at the beginning of development. The second problem is that developing systems regulate: if part of a developing system is removed (e.g. two of the cells of an embryonic sea-urchin at the four cell stage) the system often develops in such a way that a more or less normal structure is produced (in this case a small but complete sea-urchin). The third problem, Sheldrake writes, is that of regeneration, whereby organisms are able to replace or restore damaged structures. If, for example, the lens is surgically removed from a newt's eye, a new lens regenerates from the edge of the iris: in normal embryonic development the lens is formed in a different way from the skin. The fourth problem is reproduction: a detached part of the parent becomes a new organism: a part becomes a whole.

**(2) Behaviour.**
"If the problems of morphogenesis are dauntingly difficult" Sheldrake writes "those of behaviour are even more so." Consider the behaviour of European cuckoos. The young are hatched and reared by birds of other species, and never see their parents. Towards the end of summer, the adult cuckoos migrate to their winter quarters in Southern Africa. About a month later the young cuckoos congregate and then also migrate to the appropriate region of Africa. They instinctively know that they should migrate and when to migrate; they instinctively recognise other young cuckoos and congregate with them; and they instinctively know their destination. Sheldrake maintains, and few will deny, that an enormous gulf of ignorance lies between such phenomena and the established facts of molecular biology, biochemistry, genetics and neurophysiology. How could the migratory behaviour of a young cuckoo ultimately be explained in terms of DNA and protein synthesis? A satisfactory explanation would require more than a demonstration that genes containing appropriate base-sequences of the DNA code were necessary for this behaviour, or that the behaviour of cuckoos depended on electrical impulses in nerves; it would require some understanding of the connections between specific sequences of bases in the DNA, the bird's nervous system, and the

migratory behaviour. Even then there would still be the problem of how the nervous system, with its characteristic pattern of 'wiring' came into being in the animal as it developed.

### (3) Evolution.

Sheldrake emphasises the metaphysical problems that attend any theory of evolution. Vitalist and organismic theories necessarily involve an extrapolation of vitalist and organismic ideas, just as the neo-Darwinian theory involves an extrapolation of mechanistic ideas. This is unavoidable; evolution will always have to be interpreted in terms of ideas which have already been formed on other grounds. Thus the problem of evolution cannot be solved conclusively. (Sheldrake evidently accepts that evolution has occurred, and thus rejects, or at any rate eschews, a creationist position.)

### (4) The Origin of Life.

This problem is just as insoluble as that of evolution, and for the same reasons.

### (5) Psychology.

The mechanistic theory of mind cannot be taken for granted; at present the idea that all the phenomena of psychology are in principle explicable in terms of physical laws is no more than speculative. For example although several different mechanistic hypotheses of memory have been advanced — in terms of reverberating circuits of nervous activity, or changes in synaptic connections between nerves, or specific molecules of RNA — there is no persuasive evidence that any of these proposed mechanisms can in fact account for memory. If memories are not stored physically within the brain, then certain types of memory need not be confined to individual minds; Jung's notion of an inherited collective unconscious containing archetypal forms[3] could be interpreted as a kind of collective memory.

### (6) Parapsychology.

Although investigators in the field of psychical research have discovered many cases of fraud, and found that some apparently paranormal events can in fact be explained by normal causes, there remains, Sheldrake holds, a large body of evidence which seems to defy explanation in terms of any known physical principles. Numerous experiments designed to test for so-called extra-sensory perception or for psychokinesis have yielded positive results with odds against chance coincidence of thousands to billions to one against.

Sheldrake's conclusion from his review of these major problems in biology is that there is little room left for thinking that they can all be solved by an exclusively mechanistic approach. He suggests the hypothesis of formative causation, whereby in addition to the types of energetic causation known to physics, and in addition to the causation due to the structures of known physical fields, a further type of causation is responsible for the forms of all material morphic units from sub-atomic particles to whole organisms. Form, here, includes the internal structure of the morphic unit. This causation, called formative causation, imposes a spatial order on changes brought about by energetic causation. It is not itself energetic, nor is it reducible to the causation brought about by known physical fields. The characteristic form of a given morphic unit is determined by the forms of previous similar systems which act upon it across time and space by a process called morphic resonance. The most frequent type of previous form makes the greatest contribution by morphic resonance to subsequent forms. Morphogenetic fields are not precisely defined but are represented by probability structures which depend on the statistical distribution of previous similar forms. The probability distributions of electronic orbitals described by solutions of the Schrodinger equation are examples of such probability structures, and are similar in kind to the probability structures of the morphogenetic fields of morphic units at higher levels.

## A biologist's verdict

Few biologists are likely to accord "A New Science of Life" an enthusiastic welcome. Though superior to books like Schul's "The Psychic Power of Animals",[4] which argued that animals possess a sixth sense and can predict the future, and Lilly's books on the super-intelligence of dolphins,[5,6] Sheldrake's work will still be seen by many to belong to that genre of pseudo-science. The most convincing part of his thesis is that there is still a tremendous amount that remains to be understood in biology. Sheldrake, however, is unlikely to find much support in the orthodox scientific community for his contention that the mechanistic paradigm is inadequate; it has served biology and the rest of science too well for many scientists to be willing to shift their allegience to a different paradigm. Scientists, we are told, are notoriously unwilling to adopt new paradigms even when the pressure for them in considerable.[7,8]

Sheldrake, aside from detailing what he feels are inadequacies in a materialistic theory of science, lists positive evidence for his hypothesis of formative causation. This evidence, however, is inadequately presented, frequently anecdotal, and generally inconvincing. For example, Sheldrake argues that chemists who have synthesized entirely new chemicals often have great difficulty in gettng these substances to crystallize for the first time. But as time goes on, these substances tend to crystallize with greater and greater ease. This observation is exactly what would be predicted by the hypothesis of formative causation. The sole evidence for this statement, which is a major part of the evidence Sheldrake gives for his theory, comes from a single unquantitative and anecdotal account written over twenty years ago.[9] Similarly his defence of parapsychology makes no mention of the many detailed but unsuccessful attempts convincingly to demonstrate paranormal events under circumstances which remove the possibility of fraud, and which adequately consider the often very considerable statistical problems that exist.[14-16]

Book reviews and letters about Sheldrake's book have generally been unflattering or downright hostile.[1,10,11] The most favourable comments have come from non-biologists sympathetic to Sheldrake's attempt to suggest a rigorous alternative to materialism.[12,13] A strength of the book is its definite attempt to suggest tests for the hypothesis of formative causation. Nevertheless I suspect that few tests are likely to be performed. Negative results might always be due to inadequate sample sizes, as Sheldrake makes no quantitative predictions of the strength of his morphogenetic fields. Biologists, anyway, are frequently loath to test unconventional hypotheses; witness the few tests of Lamarckianism despite Koestler's defence of Paul Kammerer.[17-20]

## A Christian response

In an editorial Nature wrote of "A New Science of Life": "This infuriating tract has been widely hailed by the newspapers and popular science magazines as the "answer" to materialistic science, and is now well on the way to being a point of reference for the motley crew of creationists, anti-reductionists, neo-Lamarckians and the rest." Professor R.J. Berry, however, argues[11] that Sheldrake's book is not a significant blow to the credibility of evolution, and I believe he is correct. Creationists would be unwise to cite Sheldrake as a champion of their cause. Sheldrake maintains that the hypothesis of formative causation does account for the repetition of forms, but he admits that it does not explain how the first example of any given form originally came into being. "This unique event can be ascribed to chance, or to a creativity inherent in matter, or to a transcendent creative agency." In his last chapter Sheldrake considers four possible conclusions. He briefly outlines four metaphysical theories, all of which are equally compatible with the hypothesis of formative causation. (1) Modified materialism; in which materialism is modified to incorporate the idea of formative causation. (2) The conscious self; here the conscious self is admitted to have a reality which is not merely derivative from matter. This view leads to the conclusion that the conscious self and the body interact. (3) The creative universe; although a creative agency capable of giving rise to new forms would necessarily transcend individual organisms, it need not transcend all nature. It could, for instance, be immanent within life as a whole; in this case it would correspond to what Bergson called the élan vital.[21] Or it could be immanent within the planet as a whole, or the solar system, or the entire universe. (4) Transcendent reality; "The universe as a whole could have a cause and a purpose only if it were itself created by a conscious agent which transcended it. Unlike the universe, this transcendent consciousness would not be developing towards a goal; it would be its own goal. It would not be striving towards a final form; it would be complete in itself."

Sheldrake holds that a decision between these alternatives can be made only on metaphysical grounds.

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# BOOK REVIEWS

## Man: Ape or Image - The Christian's Dilemma — John Rendle-Short *

Creation Science Publishing, P.O. Box 302, Sunnybank, Q 4109 Australia, 1981.
195 pages. No price given.

Professor John Rendle-Short, a professor of Child Health in Queensland, is the son of a well-known surgeon and christian writer. This volume is a fresh and forceful study of the creation question. It merits high praise and a wide readership for several reasons. Firstly, the book gets quickly to the centre of the controversy, namely, the original perfection of the world and the *subsequent* entry of suffering and death into the human race. Although topics such as the age of the earth are considered later, they are not allowed to confuse the main point. The author competently traces the biblical rationale of redemption from man's primaeval transgression: 'Death was the curse, so death would be the cure' (p. 71), and he effectively argues the incompatibility of this view with theistic-evolutionism. Secondly although the approach is primarily biblical the author's wide reading and grasp of scientific and cultural issues is apparent. Some of the more technical questions are treated in appendices and footnotes. The implications of what we believe about origins are discussed in relation to marriage, the family and society. As befits a christian paediatrician there is pastoral warmth and a wealth of illustration from his experience. Finally, the style is clear and understandable so as not to daunt the layperson. Yet there is sufficient depth and detail to reward the specialist. Consequently the book is an effective and convincing apologetic. Not withstanding these merits, an earlier reviewer — a respected Christian leader —dismissed the volume as containing a 'popular but very misleading argument as a major thesis' (concerning the goodness of God in relation to the existence of evil). He went on to suggest that since God either permits or wills present suffering, may he not have employed the same in an evolutionary scheme of creation? However this is precisely the point which Rendle-Short tackles and answers: No!

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* This review first appeared in the *Evangelical Times.*

David Watts.

## The Neck of the Giraffe or where Darwin went wrong.
### Francis Hitching

Pan Books, London (1982) 288 pages £2.50

This is a popular book to which Creationist thought has contributed and from which we can also learn. It is instructive because although the author firmly rejects neo-Darwinism he also rejects creationism. Instead he looks to the 'new Biology' to provide a valid mechanism for evolutionary change. The book is clearly organised into three parts: Impasse; Alternatives; Dogma. The impasse is the total failure of neo-Darwinism as a naturalistic mechanism. The evidence is surveyed from palaeontology, the limits of natural selection and the statistical odds against both the origin of life and the occurrence of sufficient beneficial mutations to promote macro-evolution.

Many of the arguments familiar from creationist literature are rehearsed. There is careful documentation and the use of boxed-in 'panels' to deal with more technical themes. Chapter four, on biological 'oddities' is particularly good. The alternatives surveyed in part 2 include creationism, 'hopeful monsters' (Goldschmidt) and Lamarckism — including a synopsis of Ted Steele's research. Catastrophism is discussed in relation to extinction mechanisms and punctuated equilibria theory. A note on mathematical catastrophe theory is included. The final section deals with the ways in which various different views — and especially Darwinian theory — have hardened into unchallengeable dogma. Examples are given of the way in which evidence has been falsified (e.g. Haeckel). The author concludes with a survey of the 19th century background to Darwin's thought.

The book gives a good impression of the way some modern Biologists are striving to make their science more rigorous, objective and self-critical. All this is most welcome. It is refreshing to read a book which so concisely sets out the various models of biological change. It is not necessary to defend creationism in the scope of this review. Suffice it to say however that many of us do not wish to pre-judge every possible scientific issue by appeal to *Genesis.* Where the Bible speaks about nature we gladly submit to its teaching. But where Scripture is silent, we must be agnostic and avoid speculation and *unwarranted* 'dogma'. Let us learn from this volume where the debate is going today and equip ourselves to evaluate the new conventional wisdom.

David Watts

## In the Beginning — Roger D.G. Price

Dunestone Printers Ltd., Newton Abbott, Devon pp. 99 £2.25 1979

In this book Roger Price gives a clear and competent account of the biblical basis of and scientific support for special creation. He starts by setting the biblical and evolutionary accounts of origins in contrast; he then works through the case for this biblical view following the creationist model that we have come to associate with the N. American creationist school (i.e. young earth, canopy atmosphere, flood geology).

The book concentrates on exposition; the language is clear and the argument always well-supported. The pace is a little relentless at times and one could have wished for more discussion of the alternative evolutionary positions. The author turns his own background in geography teaching to good purpose; I found the chapters on the geology of the earth's surface and on the cultural development of man after the flood particularly good.

At times there is a tendency to prove too much. Is there really evidence for dinosaurs and the Ice Age in the book of Job? The book is well illustrated with charts and line drawings: but I found the colour plates distracting and unhelpful.

Overall a book to be recommended to a wide range of readerships as one which covers a lot of ground in a thorough manner. Read in conjunction with Edgar Andrews' *From Nothing to Nature* with its wider-ranging discussion of the general issues involved in the debates a careful student would be well equipped to tackle some of the more specialised books in the field.

Charles Whitworth

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